The SWOT downstream program:

The use of satellite data for a better water resources management

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SWOT DOWNSTREAM

cnes

A step forward in hydrology with the SWOT Mission

Surface Water and Ocean Topography

NASA–CNES–CSA mission ; dedicated to inland water and oceans.

Ka-band SAR interferometric system with **2 swaths, 50km each** + Nadir altimeter (Jason class)

21 days repeat-cycle, Launch **Sept. 2021**

2D images of water level with high vertical accuracy

For rivers width >100m and lakes, reservoirs and wetlands > $(250\ m)^2$

Height vertical accuracy of **10 cm for rivers**

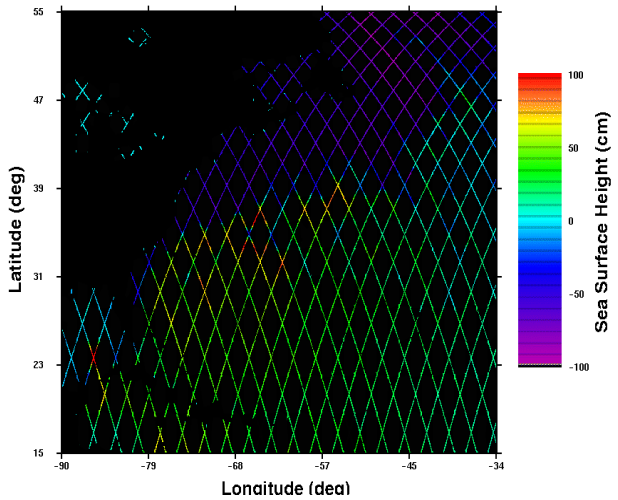
FREE ACCESS to all data and products

First global inventory of all terrestrial water bodies

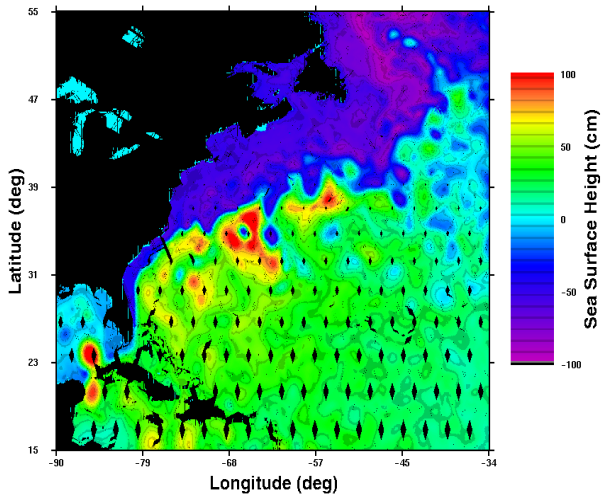
➔ Global storage change

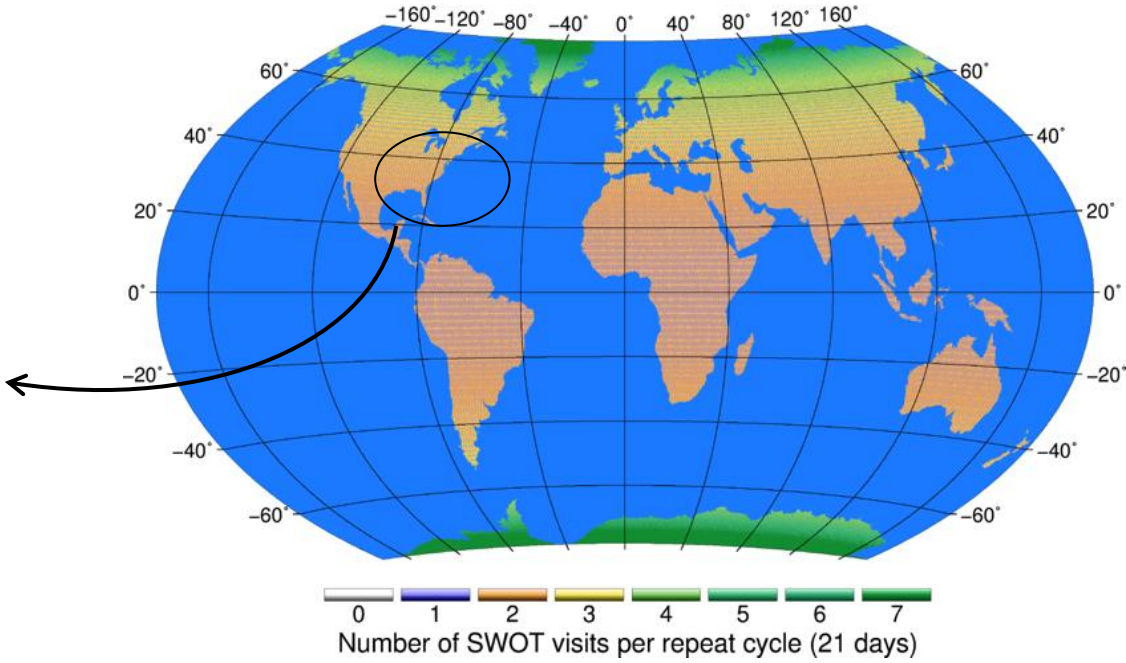
➔ Global change in river discharge

Conventional Altimetry - JASON



Swath Altimetry - SWOT





The SWOT downstream program

1 OUTREACH

- Inform stakeholders about space solutions in hydrology
- Develop communication strategies

2 SUPPORT EXPERTS AND RESEARCHERS

- To reach an earth modeling system and better understand water cycle

3 SWOT SIMULATED PRODUCTS

- Airborne campaign : AIRSWOT
- To ease the integration of the future SWOT data in users solutions.

4 HYDROWEB-NG

- A multi-sensor platform to give one central access to all products from satellite in hydrology

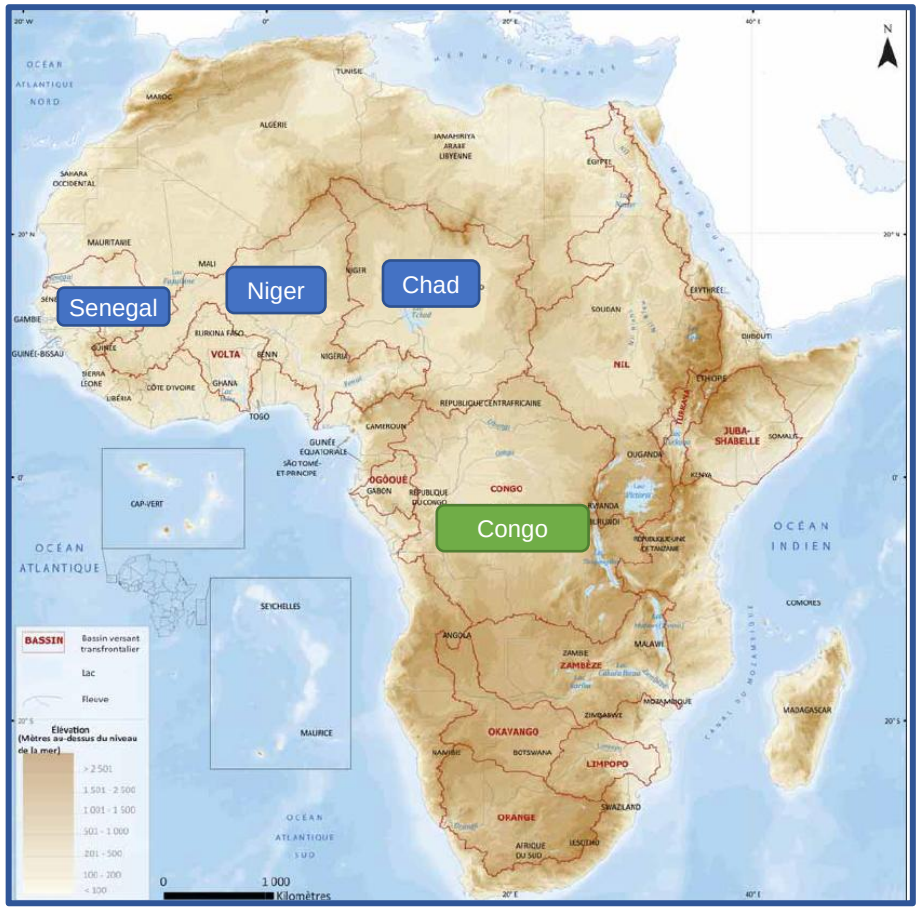
5 DEVELOPMENT OF SERVICES AND APPLICATIONS

- Create a new value chain in hydrology by using Earth observation data.
- Leverage the development new environmental services and applications

CNES activities and plans over Africa

Hydroweb-NG:

- ✓ Water levels (altimeters and SWOT)
- ✓ Water quality
- ✓ Land use map
- ✓ Soil moisture, drought index
- ✓ Rainfall
- ✓ Evapotranspiration



Capacity building, training, support to **local** stakeholders

Involved parties

Basins organizations

- ABN : Niger basin
- CICOS : Congo basin
- CBLT : Lake Chad basin
- OMVS : Senegal basin

Private companies in hydrology

- CLS
- CNR
- BRLi

Institutional bodies

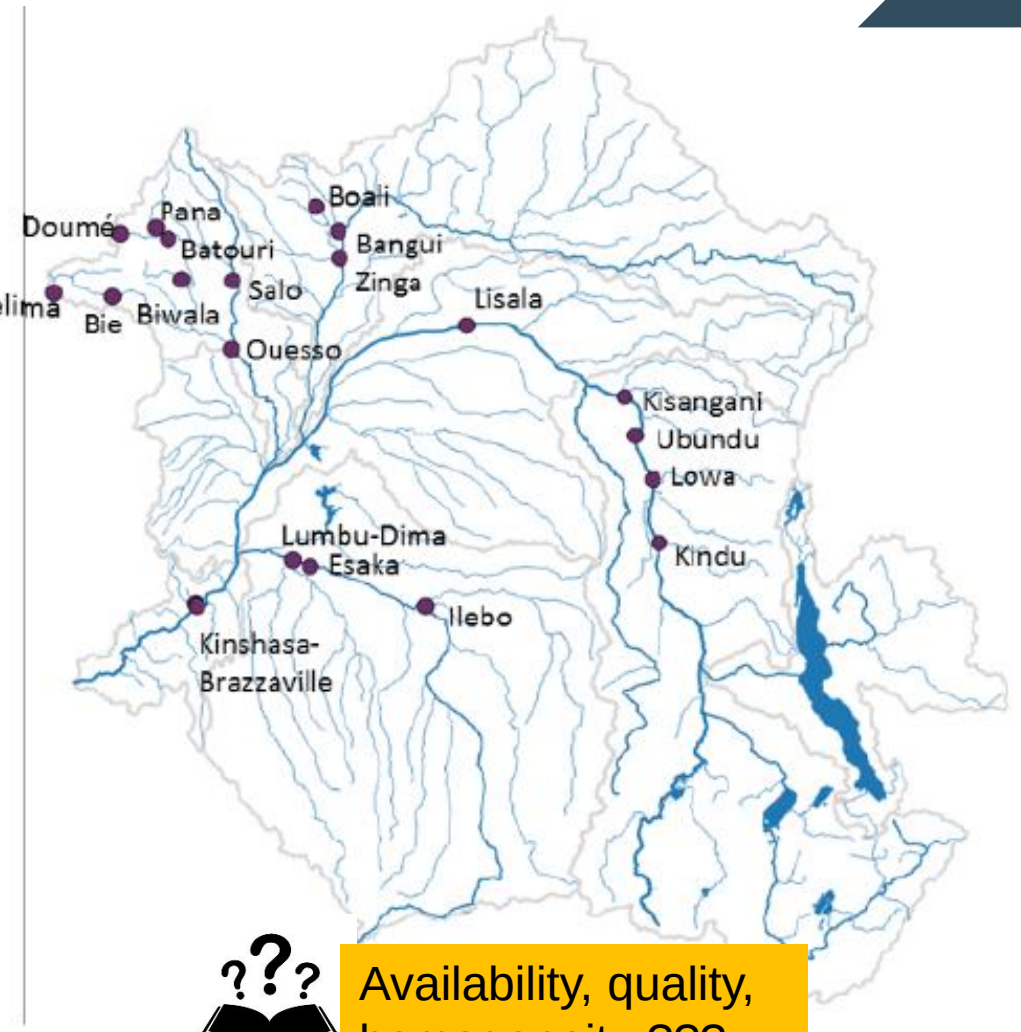
- IRD
- AFD
- OIEAU

Scientific laboratories

- CESBIO, CIRAD, CNRM, GET, IRD, IRSTEA, LEGOS

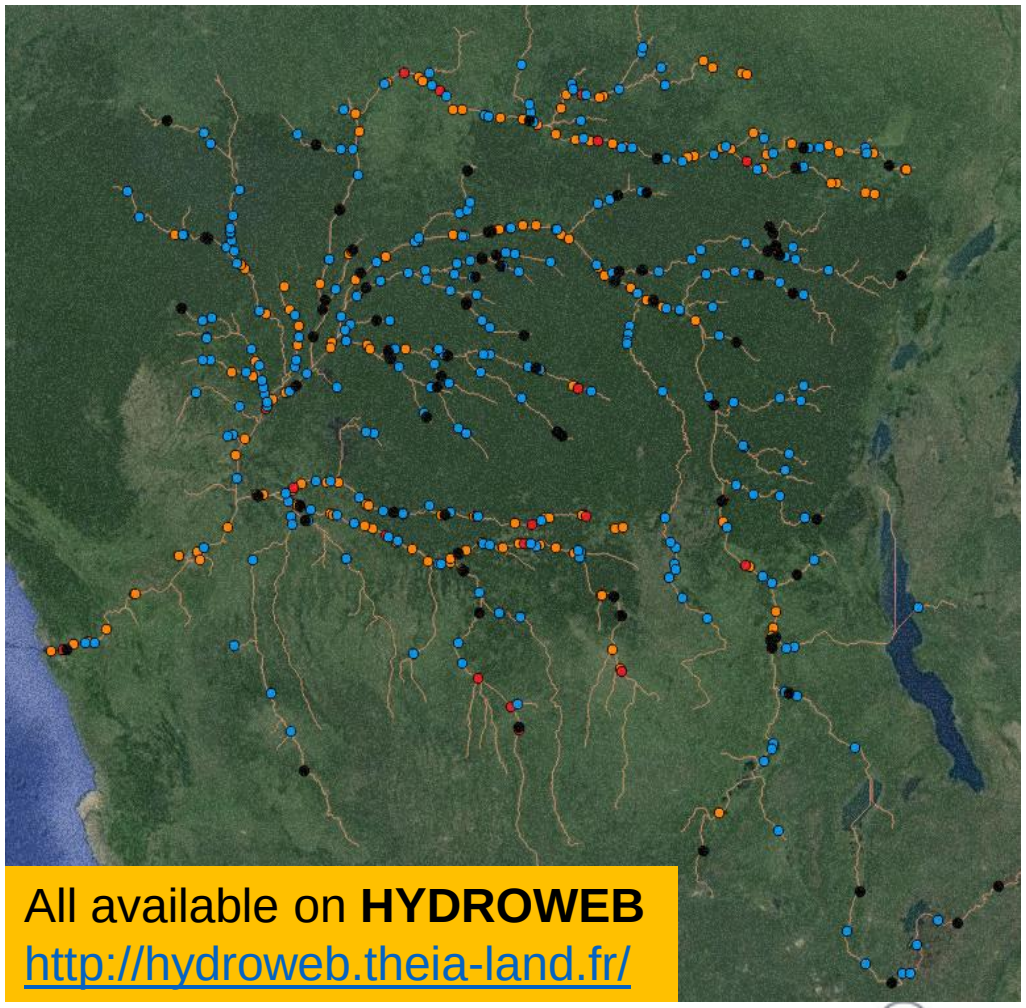
What we did over the Congo basin ?

From 20 working water level stations



Availability, quality, homogeneity ???

To almost 550 virtual stations and time series since 1992

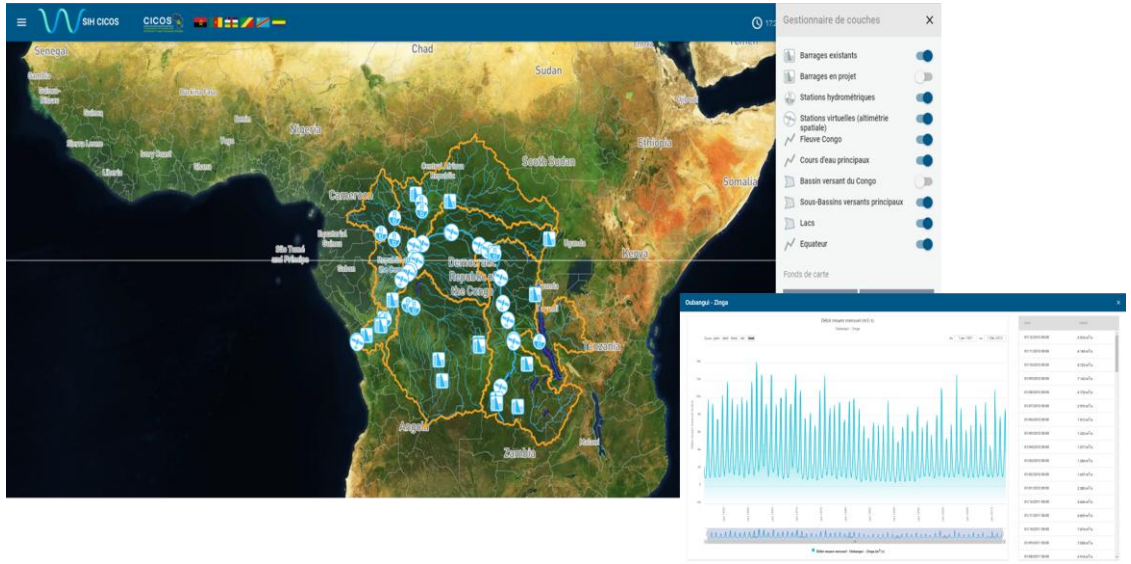


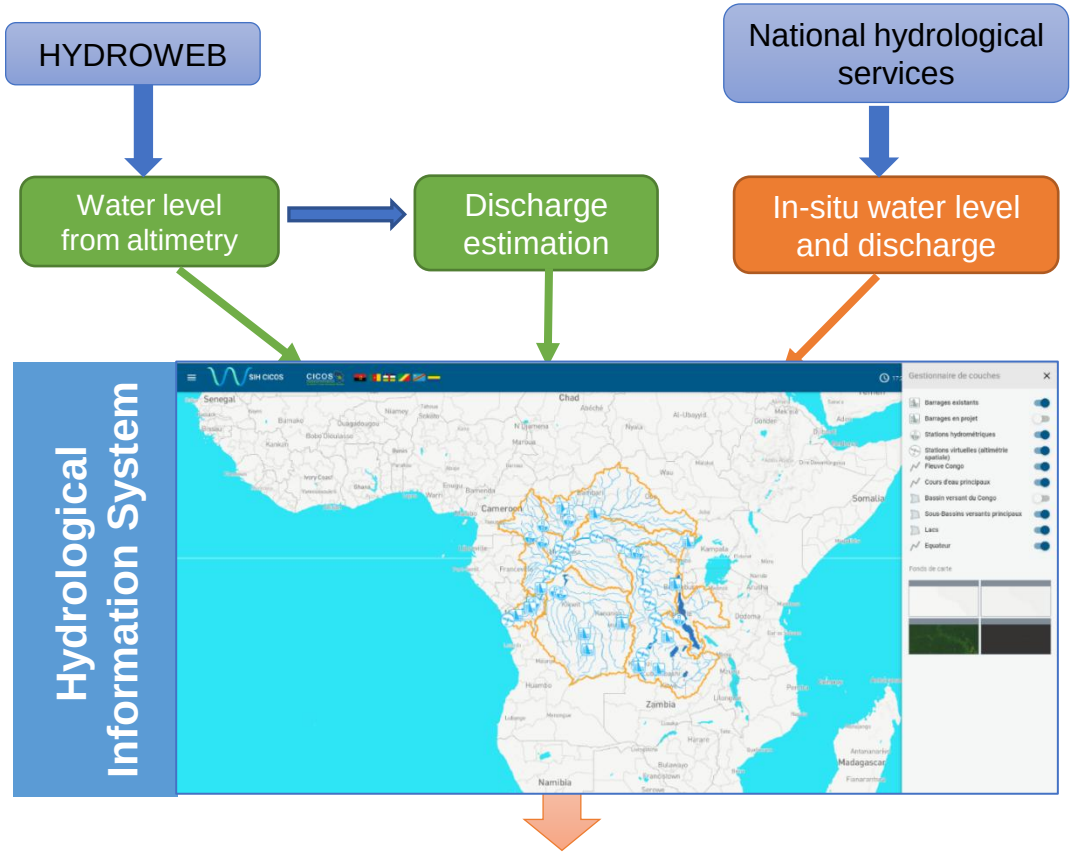
All available on **HYDROWEB**
http://hydroweb.theia-land.fr/

What we did over the Congo basin ?

Operational Tool gathering in-situ + altimetry data

➔ Used by the CICOS, the Congo basin organization

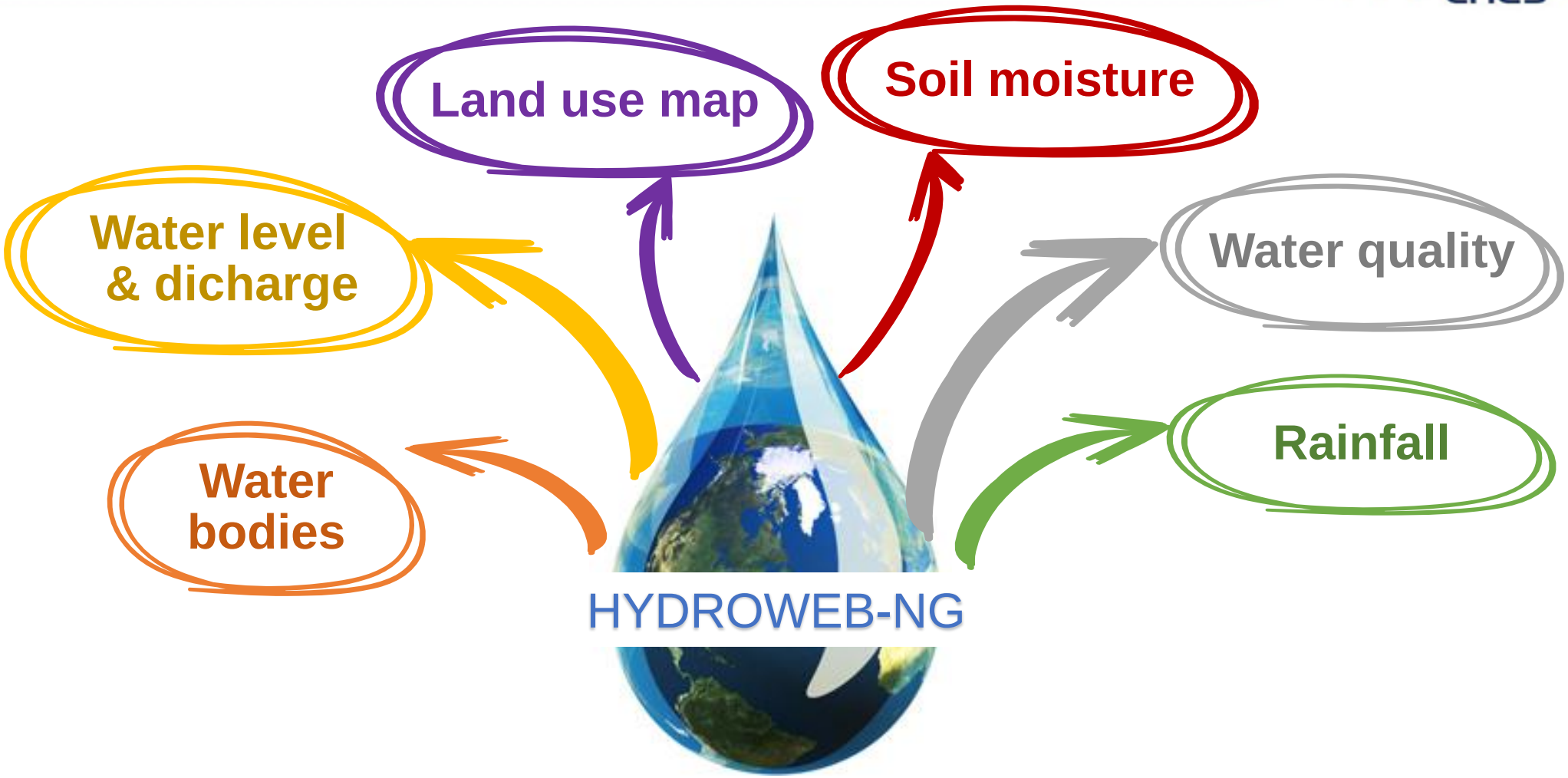




Applications and services:
Navigation forecast – hydropower potential
Integrated water resources management,

***Funded by AFD**, France's inclusive public development bank*

And next ? On-going work on other variables

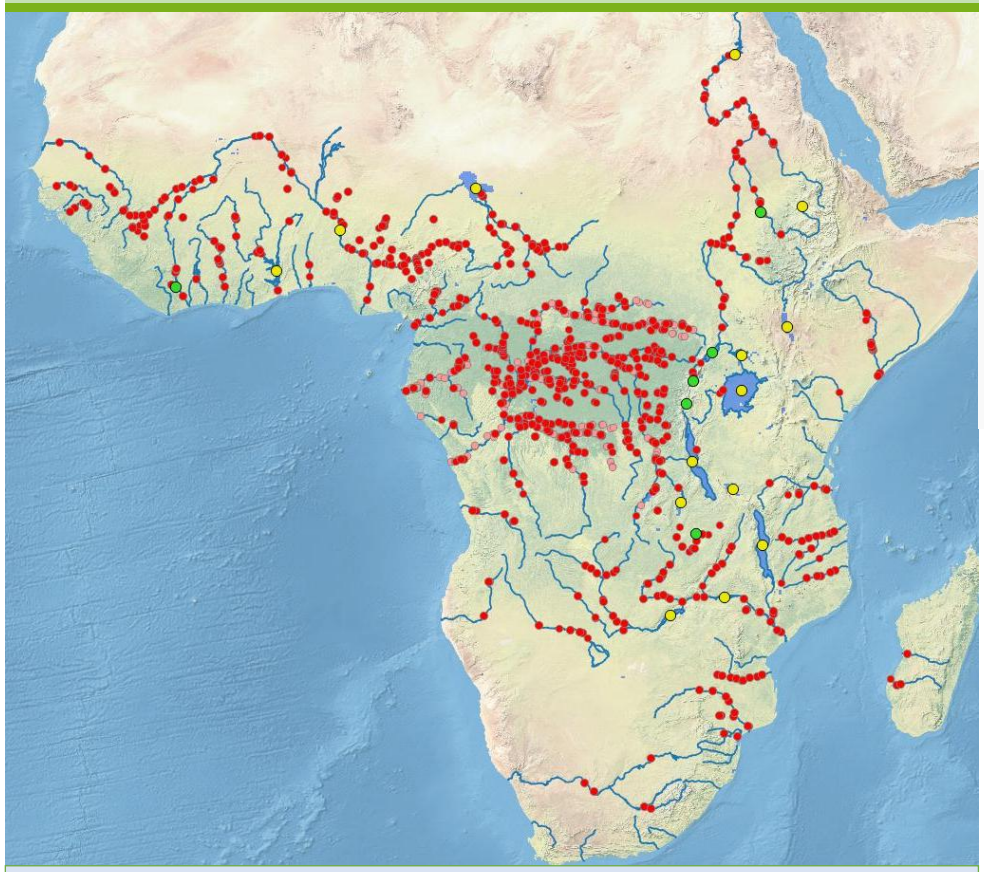


- ✓ Single access point for hydrology products from EO
- ✓ Multi-sensors approach
- ✓ Global scale targeted when possible
- ✓ Appropriate spatial and temporal resolutions
- ✓ Free access to data for all users
- ✓ Standardization of data, interoperability

And next ? On-going work on other variables

Water level

Available now on HYDROWEB

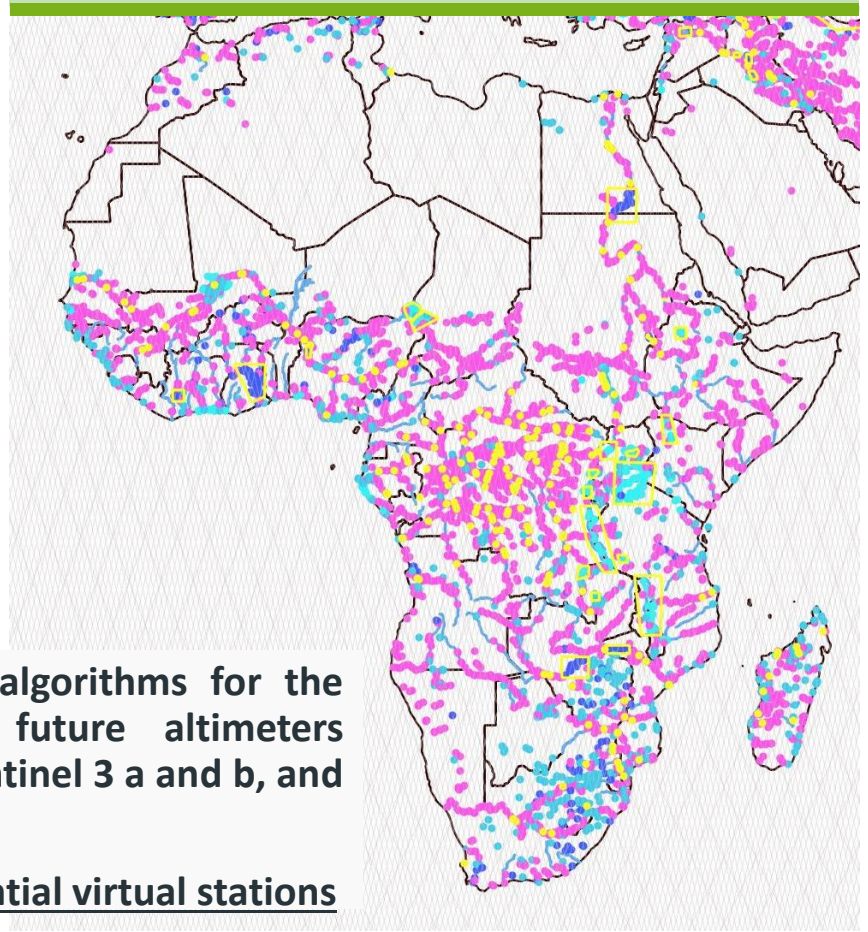


http://hydroweb.theia-land.fr

Same work made over the Congo applied to other African basins

Now 955 virtual stations

Future work



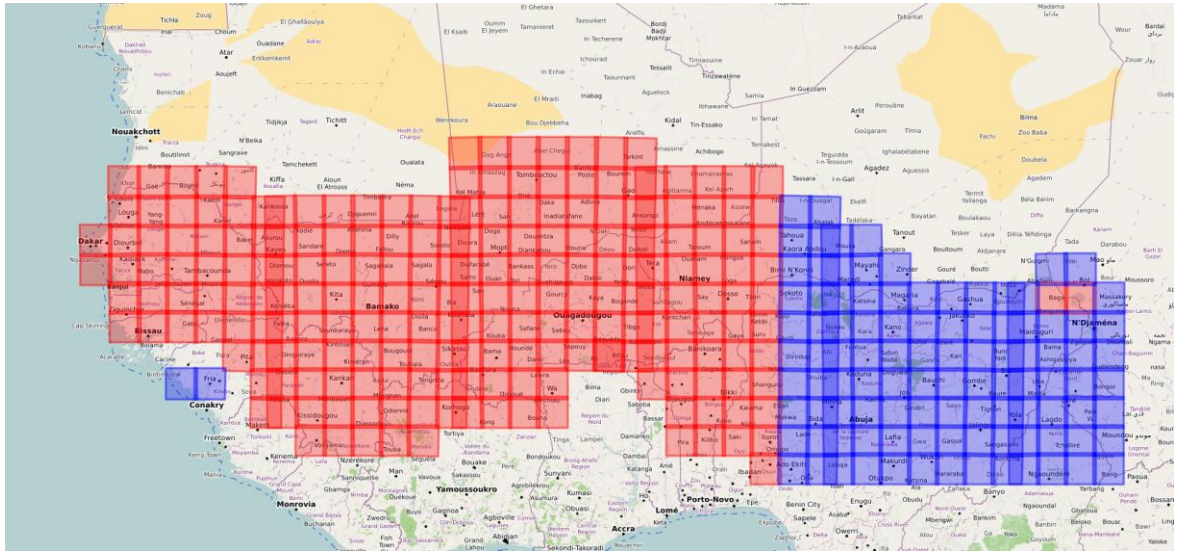
Apply new algorithms for the latest and future altimeters (Jason 3, Sentinel 3 a and b, and next).

~5 000 potential virtual stations

And next ? On-going work on other variables

Land cover

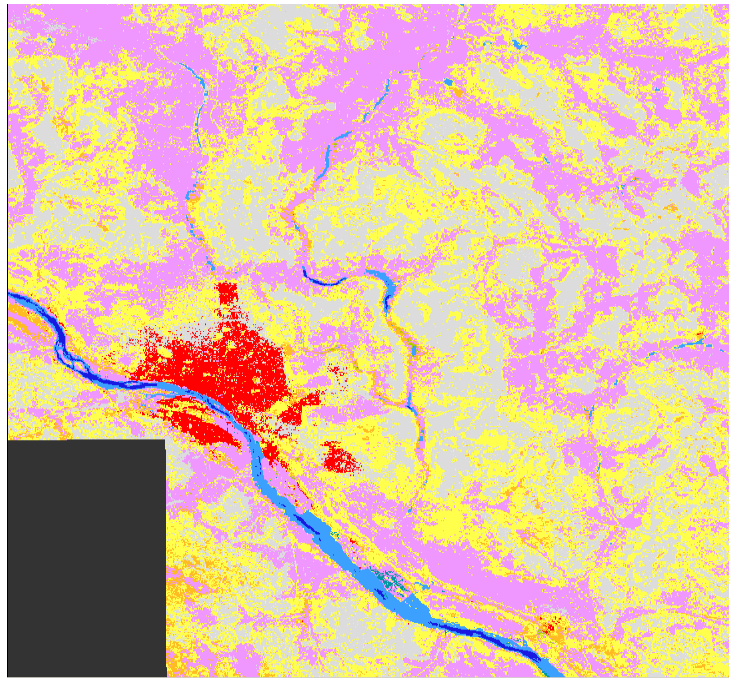
West Africa maps

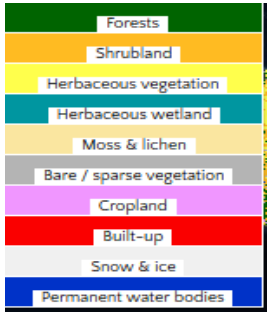


Theia Sentinel 2-L2A coverage over West Africa

Iota 2

LULC – 2018 season (Niamey, Niger)





Next steps :

- Validating results in Sénégal, Burkina and Niger areas with IRD agents
- Annual land cover map over all West Africa (2019-2020)

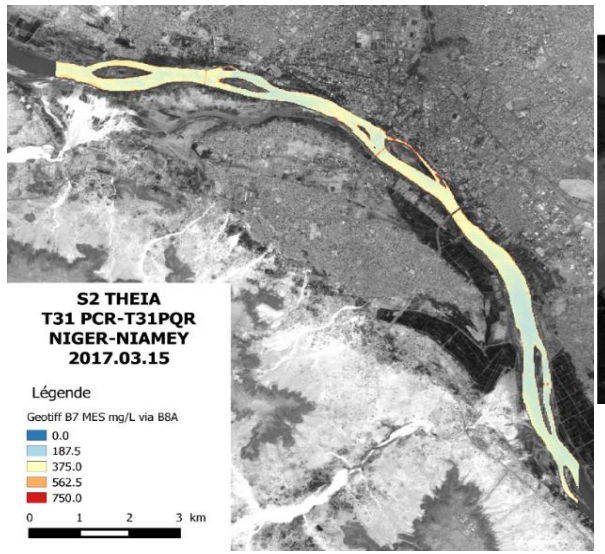
And next ? On-going work on other variables

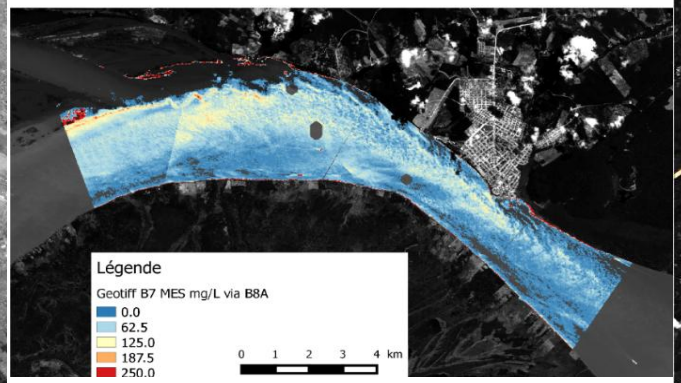
Water quality

- ✓ Suspended Matter
- ✓ Turbidity/transparency
- ▪ Colored dissolved organic matter
- ▪ Chlorophyll-a
- ▪ River sediment discharge in preparation of SWOT mission

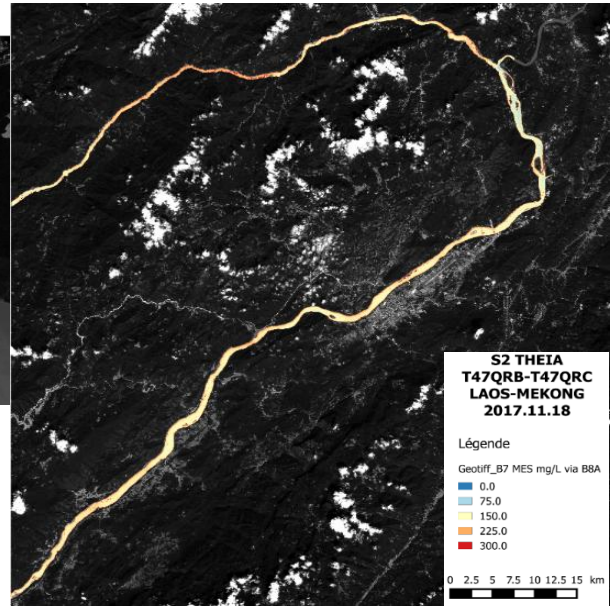
➔ Image (20m resolution) + time series

- Available on THEIA website : https://theia.cnes.fr
- Increase the number of sites : from 20 to 150 sites in 2020





Traitement OBS2CO1.1 UMR GET/IRD
MNDWI
S2 THEIA T21MXT AMAZONE-OBIDOS 2017.07.19



Summary and perspectives

THE SWOT DOWNSTREAM PROGRAM

- To ease the use of spatial data in hydrology
- To leverage new services and applications
- To be prepared to the future SWOT data
- Link with GEOGLOWS and AMERIGEOS activities

HYDROWEB-NG

- Water database under development
- Will distribute SWOT hydrology products and all other products of interest in hydrology :
  - Surface water bodies, water quality products, land use maps, soil moisture and by-products, etc.
- Objectives = Free, global scale when possible

THE CONGO BASIN : THE FIRST PILOT PROJECT

- Operational use of altimetry data demonstrated.
- Next work on other hydrological variables

➔ Looking for funding to start those activities

OTHER BASINS

- Working plan on all variables made for the Chad and Niger basins
- Beginning of discussions on the Senegal basin
- Earth observations as a complement of in-situ data
- Funding issues crucial for sustainable activities


Yukon delta, Sentinel 2 - ESA

CONFERENCE
South America Water from Space
4-7 nov. 2019 ; Manaus, Brazil

https://hydrologyfromspace.org/
(registration open!)

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